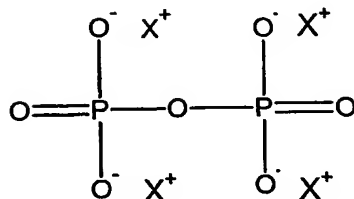


## CLAIMS

The following is claimed:

- 5 1. A method of providing vascular calcification therapy to an individual in need of treatment comprising the step of administering to the individual an effective amount of a pyrophosphate-type compound.
2. The method of claim 1, wherein the pyrophosphate-type compound is an alkali  
10 metal pyrophosphate.
3. The method of claim 1, wherein the pyrophosphate-type compound is chosen from tetraalkali metal pyrophosphate, dialkali metal diacid pyrophosphate, trialkali metal monoacid pyrophosphate, and mixtures thereof.  
15
4. The method of claim 1, wherein the pyrophosphate-type compound is chosen from tetrasodium pyrophosphate, tetrapotassium pyrophosphate, dicalcium pyrophosphate, phosphoric acid, sodium acid pyrophosphate, sodium dihydrogen pyrophosphate, and mixtures thereof.  
20
5. The method of claim 1, wherein the vascular calcification is caused by renal disease or failure.
6. The method of claim 1, further comprising treating the individual with dialysate.  
25
7. The method of claim 1, wherein the pyrophosphate-type compound is administered to the individual in a dialysate fluid.
8. The method of claim 1, wherein the pyrophosphate-type compound is  
30 administered to the individual during dialysis.

9. The method of claim 1, wherein the pyrophosphate-type compound has the following structural formula:



wherein the X is chosen from at least one of a hydrogen and a cation.

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10. The method of claim 9, wherein each X is individually chosen to be at least one of: hydrogen, sodium, potassium, and calcium.

11. The method of claim 1, wherein the pyrophosphate-type compound is  
10 administered to the individual in a dialysate fluid at a concentration of pyrophosphate-type compound of at least about 1  $\mu\text{M}$ .

12. The method of claim 1, wherein the pyrophosphate-type compound is  
administered to the individual in a dialysate fluid at a concentration of pyrophosphate-  
15 type compound from about 1  $\mu\text{M}$  to about 10  $\mu\text{M}$ .

13. The method of claim 1, wherein the pyrophosphate-type compound is  
administered to the individual in a dialysate at a concentration from about 3  $\mu\text{M}$  to about  
5  $\mu\text{M}$ .

14. A method of prophylactically treating vascular calcification comprising administering to an individual in need of treatment an effective amount of at least one pyrophosphate-type compound.

5 15. The method of claim 14, wherein the pyrophosphate-type compound is an alkali metal pyrophosphate.

16. The method of claim 14, wherein pyrophosphate-type compound is administered to the individual in a dialysate.

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17. A pharmaceutical composition comprising at least one pyrophosphate-type compound in combination with a pharmaceutically acceptable carrier, wherein the at least one pyrophosphate-type compound is present in a dosage level effective to treat vascular calcification.

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18. The pharmaceutical composition of claim 17, wherein the at least one pyrophosphate-type compound is an alkali metal pyrophosphate.

19. The pharmaceutical composition of claim 17, wherein the at least one pyrophosphate-type compound includes pharmaceutically acceptable salts of the pyrophosphate-type compound.

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20. The pharmaceutical composition of claim 17, wherein the at least one pyrophosphate-type compound includes pharmaceutically acceptable prodrugs of the pyrophosphate-type compound.

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21. The pharmaceutical composition of claim 17, wherein the pharmaceutically acceptable carrier is a dialysate.

22. A method of hemodialyzing an individual in need thereof, comprising the steps of:  
diffusing dialysate comprising at least one pyrophosphate-type compound across a  
membrane in a hemodialysis system; and

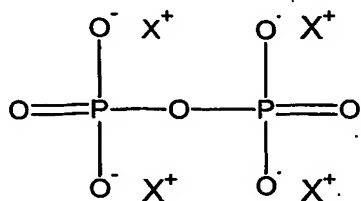
5 exposing the individual to an effective amount of the pyrophosphate-type  
compound.

23. The method of claim 22, wherein the pyrophosphate-type compound is an alkali  
metal pyrophosphate.

10 24. The method of claim 22, further comprising treating vascular calcification in the  
individual through exposing the individual to an effective amount of the pyrophosphate-  
type compound.

25. A dialysate concentrate comprising at least one pyrophosphate-type compound.

26. The dialysate concentrate of claim 25, wherein the at least one pyrophosphate-type compound has the formula of the following structure:



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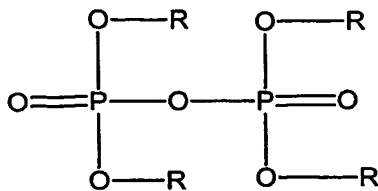
wherein the X is chosen from at least one of a hydrogen and a cation.

27. The dialysate concentrate of claim 26, wherein each X is individually chosen to be at least one of: hydrogen, sodium, potassium, and calcium.

10

28. The dialysate concentrate of claim 25, wherein the pyrophosphate-type compound is present in the dialysate concentrate at a concentration of about 50  $\mu\text{M}$  to about 1 mM.

29. The dialysate concentrate of claim 25, wherein the at least one pyrophosphate-type compound has the formula of the following structure:

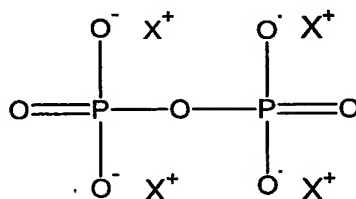


- 5 wherein R is individually chosen to be a functional group of at least one of hydrogen, alkyl groups, aryl groups, halo groups (F, Cl, Br, and I) hydroxy groups, alkoxy groups, alkylamino groups, dialkylamino groups, acyl groups, carboxyl groups, carboamido groups, sulfonamide groups, aminoacyl groups, amide groups, amine groups, nitro groups, organo selenium compounds, hydrocarbons, cyclic hydrocarbons, hydrogen, nitrogen,  
10 oxygen, sulphur, NR, and CR.

30. A hemodialysis system, comprising:  
 a blood compartment;  
 a membrane in fluidic communication with the blood compartment; and  
 a dialysate compartment, the dialysate compartment comprising a dialysate  
 5 comprising a pyrophosphate-type compound.

31. The hemodialysis system of claim 30, wherein the pyrophosphate-type compound is an alkali metal pyrophosphate.

10 32. The hemodialysis system of claim 30, wherein the pyrophosphate-type compound has the formula of the following structure:



wherein the X is chosen from at least one of a hydrogen and a cation.

15 33. The hemodialysis system of claim 32, wherein each X is individually chosen to be at least one of: hydrogen, sodium, potassium, and calcium.

34. The hemodialysis system of claim 30, wherein the pyrophosphate-type compound is administered to the individual in a dialysate at a concentration of at least about 1  $\mu\text{M}$ .